MICHIGAN DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION BUREAU
COMPREHENSIVE STUDIES SECTION

Report of an
Industrial Wastewater Survey
Conducted at
PENNWALT CORPORATION
All Outfalls No. No. 820293
Final Order of Abatement No. 1994
NPDES Permit No. MI0002381
Wayne County
Wyandotte, Michigan
September 13-14, 1982

Survey Summary

Wastewater monitoring was performed during one twenty-four hour survey period starting Monday, September 13, 1982.

The results of this survey met the final limitations in the facility's Final Order of Abatement, No. 1994 (see Table 3).

The survey results are also compared to the company's Monthly Operating Report (MOR) results for September, 1982 in Table 3. The survey BOD result is greater than the company's reported monthly maximum at outfall 821088 (006). At outfalls 820193 (003) and 820190 (002) the survey's ammonia nitrogen concentrations are greater than the company's reported monthly maximums. At outfall 820223 (005), the company reported lower suspended solids concentrations on both days of the survey. At the intake, 820409, the company reported higher suspended solids concentrations on both days of the survey.

Grab samples collected at the outfalls and the intake were split with the company for comparison of laboratory analyses. The results are shown in Table 4. The plant reported lower BOD concentrations at outfall 821066 (006) and at 820409 (the intake) and lower suspended solids concentrations at outfall 820223 (005) and at the intake. All of the company's ammonia-nitrogen results are lower than the survey results.

The results obtained in this survey are compared to the results of the previous survey conducted in August, 1981 in Table 5.

Survey Comments

The cooling water and process wastewater discharges to outfall 821088 (006) were sampled separately in addition to outfall 821088 (006). The results are shown in Table 2. Purgeable halocarbons were found at outfall 821088 (006) and in the process water that discharges to outfall 821088 (006).

Plant Processes

The Pennwalt Chemical Corporation in Wyandotte manufactures organic and inorganic chemicals in two separate, but adjacent, plants. The organics (east) plant produces chlorine, caustic soda, ferric chloride, and muriatic acid from salt brine, scrap iron, and other raw materials. The ammonia chloride process has been shut-down for over one year. This may be permanent. The organics (west) plant produces about 100 different organic compounds, chiefly alkylamines and rubber industry chemicals from ammonia, alcohols and other raw materials. Plant layout diagrams for the East and West plants are given in Figures 1 and 2, respectively. A process schematic for the East plant is given in Figure 3.

Production at the east plant was approximately 70% of normal. The west plant production was down from normal with several operations down. Both plants operate 24 hours/day, 7 days per week. The plants together employ 500 people, slightly more than half employed at the east plant.

Water Supply, Wastewater & Treatment

All process and cooling water used in both plants is obtained through the south intake on the Trenton Channel of the Detroit River. The south intake (820409) also services the Detroit Edison-Pennwalt Plant in the East Complex. Intake screen backwash is discharged to the Detroit Edison outfall. The intake is chlorinated on a continuous basis during the summer months only, beginning in early May and continuing into October. The company uses an average of 77 kg/day (170 lbs/day) of chlorine to treat 114,000 M3/day (30 MGD) of intake water. The North Intake, used on a back-up basis, was being used during the survey for approximately 20% of the total intake flow. The north intake was being used because of a pump problem at the south intake. The north intake screen backwash is discharged directly to the Detroit River.

Domestic water is supplied by the City of Detroit. All sanitary wastes are discharged to the Detroit sanitary sewer system.

All process and cooling waters from the organics (West) plant is treated as depicted in Figure 2. Pond 1 receives wastes from the pilot plant operation. Phenolic wastes are batch discharged from a sump to Pond 2 for equalization of loadings from the plant. The sump is tested prior to discharge to the pond, if high results are found the batch is bled into the system or hauled away for incineration. Following a third pond these wastes are mixed with other process wastes, the pH is adjusted and they are discharged to Pond 4. The cooling water, which comprises 55% of the total flow, is mixed with the process water in Pond 4. The major treatment provided by this set-up includes equalization of slug loads, settling, oil skimming, and pH adjustment as necessary using sulfuric acid or caustic. Effluent from Pond 4 are discharged to Mongaugon Creek via outfall 821088 (006).

Seal water from the liquid ferric pumps, water from the chlorine cell room drains, wash water from the evaporators, wash water from asbestos diaphram filters,

wash water from the tank room and back wash from two of the filters used to filter caustic are discharged via outfall 820223 (005). The combined waste streams are provided settling in one of two settling lagoons. Following continuous pH adjustment with carbon dioxide or sulfuric acid, if necessary, the wastewater is monitored and enters a Wayne County Drain prior to entering the Detroit River. The lagoon which is not being used for settling is dredged and the solids are injected into the brine wells.

Outfall 820193 (003) discharges cooling water from the cell room hydrogen coolers, from the HCl process and from the NaOH filtration. The pH is adjusted using sulfuric acid or caustic prior to monitoring. The effluent discharges into the Wayne County Drain #5 which goes to the Detroit River.

Outfall 820190 (002) discharges cooling water from the barametric condensers and chlorine cell room, flue gas scrubber water, sulfuric acid tank cooling water and yard drainage. About 95% of the wastewater originates from the barometric condensers. The pH of the wastewater is adjusted using carbon dioxide, sulfuric acid or caustic prior to discharge to the Detroit River.

Non-contact cooling water from the chlorine liquifaction process is discharged without treatment via outfall 820224 (001) to a storm sewer which discharges to the Detroit River.

Survey Procedure

The flows and samples were obtained as follows:

Sample Description	Flow Measurement	Sampling Methods & Location
821088 (006)	Company installed 278" broad-crested weir, 12" breath. Staff installed water level recorder.	Air activated composite sample & individual grabs collected at company weir.
Cooling Water Prior to Mixing (006)	--	Grab composite sample and individual grabs collected at manhole south of lagoon.
Process Prior to Mixing (006)	--	Grab composite sample and individual grabs collected at aeration tank west of lagoon.
820223 (005)	Company installed 11.25" parshall flume. Staff installed water level recorder.	Air activated composite sample & individual grabs collected at company weir.
820193 (003)	Company totalized.	Air activated composite sample & individual grabs collected at company site.

Sample Description	Flow Measurement	Sampling Methods & Location
820190 (002)	Company installed 23.75" & 24" parshall flumes. Staff installed water level recorder.	Air activated composite sample & individual grabs collected from manhole above flumes.
820224 (001)	Company totalizer.	Air activated composite sample & individual grabs collected from manhole at north end of plant.
820409 (Intake)	--	Submergible composite sample & individual grabs collected from South intake structure.

A water level recorder provides a continuous account of the liquid level or head above the crest of a weir or through a flume. A head versus time graph is obtained for the duration of the survey period. The total volume of wastewater over the weir or through the flume during the survey period is computed from the graph.

An automatic sampler composites samples at timed intervals. Samples may be proportional to the instantaneous flow over the weir or through the flume.

A submergible sampler obtains samples at a continuous rate.

Extractable organic and sulfide composite samples are collected by the grab composite method.

A grab composite consists of a series of individual grabs composited into one sample.

An individual grab is a single instantaneous sample.

Samples were analyzed by the Environmental Protection Bureau Laboratories located in Lansing.

Samples were preserved according to Table 6. The results of the physical, chemical and bacteriological analyses are presented in Tables 1 & 2. Letter codes for laboratory results are defined in Table 6. An organic scan parameter listing is presented in Table 7. Unless otherwise noted, all parameters in the scan were analyzed.

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Table 1 Analyses of composite samples.

Outfalls		821088 (006)		Cooling Prior to Mix (006)
Survey Period	From	9-13-82 - 1715		9-13-82 - 1805
	To	9-14-82 - 1715		9-14-82 - 1805
Computed flow rate[1] (M^3/day)		19,100		--
		mg/l	kg/day	mg/l
Suspended solids		5	100	8
Dissolved solids		150	2,900	130
COD		26	500	8
TOC		8.1	150	2.5
Sulfide		< 0.02	--	< 0.02
BOD_5		13	250	2.4
Nitrite & nitrate nitrogen-N		0.20 LH	3.8	0.03 LH
Ammonia nitrogen-N		0.51	9.7	0.02
Kjeldahl nitrogen-N		1.8	34	0.51
Total phosphorus-P		0.16	3.1	0.04
Chlorides		17.3	330	10.0
		ug/l		ug/l
Phenol		19 NB	0.36	3 NB
Total cadmium (Cd)		< 20	--	< 20
Total chromium (Cr)		< 50	--	< 50
Total copper (Cu)		< 20	--	< 20
Total nickel (Ni)		< 50	--	< 50
Total lead (Pb)		< 50	--	< 50
Total zinc (Zn)		< 50	--	< 50
Total iron (Fe)		280	5.3	560
Phenols Scan				
Phenol		13	0.25	--
Others		U	--	--

1 - Flow rates used in the computation of kg/day.
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 1 (continued)

Outfalls		Process Prior to Mix (006)	820223 (005)	
Survey Period	From	9-13-82 - 1755	9-13-82 - 1535	
	To	9-14-82 - 1755	9-14-82 - 1535	
Computed flow rate[1] (M^3/day)		--	3,060	
		mg/l	mg/l	kg/day
Suspended solids		5	29	89
Dissolved solids		196	29,000	89,000
COD		50 PS	INT	--
TOC		43 PS	1.7	5.2
Sulfide		0.81	--	--
BOD_5		55	--	--
Nitrite & nitrate nitrogen-N		0.25 LH	0.29 LH	0.89
Ammonia nitrogen-N		0.47	0.33	1.0
Kjeldahl nitrogen-N		13.	0.64	2.0
Total phosphorus-P		0.09	0.02	0.06
Chlorides		30	15,000	46,000
Sulfate (SO_4)		--	3,800	12,000
Calcium (Ca^{++})		--	8	20
Magnesium (Mg^{++})		--	< 1	--
Sodium (Na^{+})		--	11,000	34,000
Potassium (K^{+})		--	3.2	9.8
		ug/l	ug/l	
Phenol		130 NB	< 2 NB	--
Total cadmium (Cd)		< 20	< 20	--
Total chromium (Cr)		< 50	< 50	--
Total copper (Cu)		< 20	35	0.11
Total nickel (Ni)		< 50	< 50	--
Total lead (Pb)		< 50	< 50	--
Total zinc (Zn)		55	< 50	--
Total iron (Fe)		530	300	0.9
Phenol Scan #8				
Phenol		--	U (<10)	--
Others		--	U (<250)	--
Asbestos		--	Not observed	--

1 - Flow rates used in the computation of kg/day.
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 1 (continued)

Outfalls		820193 (003)		820190 (002)	
Survey Period	From	9-13-82 - 1450		9-13-82 - 1415	
	To	9-14-82 - 1450		9-14-82 - 1415	
Computed flow rate[1] (M^3/day)		(13,800)		73,200	
		mg/l	kg/day	mg/l	kg/day
Suspended solids		14	190	8	600
Dissolved solids		770	11,000	170	12,000
COD		8	100	6	400
TOC		1.2	17	1.0	73
Nitrite & nitrate nitrogen-N		0.29 LH	4.0	0.25 LH	18
Ammonia nitrogen-N		0.25	3.4	0.23	17
Kjeldahl nitrogen-N		0.59	8.1	0.41	30.
Total phosphorus-P		0.06	0.8	0.03	2
Chlorides		56	770	20	1,000
		ug/l		ug/l	
Phenol		2 NB	0.03	--	--
Total cadmium (Cd)		< 20	--	< 20	--
Total chromium (Cr)		< 50	--	< 50	--
Total copper (Cu)		< 20	--	< 20	--
Total nickel (Ni)		< 50	--	< 50	--
Total lead (Pb)		< 50	--	< 50	--
Total zinc (Zn)		< 50	--	< 50	--
Total iron (Fe)		700	10	390	29

1 - Flow rates used in the computation of kg/day (obtained from company totalizer).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 1 (continued)

Outfalls		820224 (001)		820409 (Intake)
Survey Period	From	9-13-82 - 1305		9-13-82 - 1555
	To	9-14-82 - 1305		9-14-82 - 1555
Computed flow rate[1] (M^3/day)		(13,000)		--
		mg/l	kg/day	mg/l
Suspended solids		10	100	7
Dissolved solids		130	1,700	140
COD		8	100	5
TOC		2.0	26	1.9
Sulfide		--	--	< 0.02
BOD_5		--	--	2.0
Nitrite & nitrate nitrogen-N		0.24 LH	3.1	0.17 LH
Ammonia nitrogen-N		0.20	2.6	0.26
Kjeldahl nitrogen-N		0.36	4.7	0.41
Total phosphorus-P		0.03	0.4	0.02
Chlorides		9.6	120	9.0
		ug/l		ug/l
Phenol		5 NB	0.06	4 NB
Total cadmium (Cd)		< 20	--	< 20
Total chromium (Cr)		< 50	--	< 50
Total copper (Cu)		< 20	--	< 20
Total nickel (Ni)		< 50	--	< 50
Total lead (Pb)		< 50	--	60
Total zinc (Zn)		< 50	--	< 50
Total iron (Fe)		310	4.0	260
Phenols Scan				
Phenol		--	--	U (<10)
Others		--	--	U (<250)

1 - Flow rates used in the computation of kg/day (obtained from company totalizer).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

Table 4 Comparison of the laboratory analytical results obtained by Pennwalt Corporation - Wyandotte and the Environmental Protection Bureau from the split grab sample.

Outfall	821088 (006)		820223 (005)	
Sample Time & Date	9-14-82 - 0925		9-14-82 - 0830	
	Pennwalt	E.P.B.	Pennwalt	E.P.B.
Flow[1] (M^3/day)	21,400	19,100	--	--
	mg/l	mg/l	mg/l	mg/l
Suspended solids	8.1	4	4.6	68
COD	15.7	15	14.3	INT
Sulfide	0.0	< 0.02	--	--
BOD_5	1.1	8.1	--	--
Ammonia nitrogen-N	0.3	0.54	0.19	0.26
Chloride	19.8	19.0	13,418	15,000
Phenol	0.040	0.051	--	--
Total zinc	Not reported	< 0.05	--	--
Total lead	--	--	0.010	< 0.050

Outfall	820193 (003)		820190 (002)	
Sample Time & Date	9-14-82 - 0805		9-14-82 - 0745	
	Pennwalt	E.P.B.	Pennwalt	E.P.B.
Flow[1] (M^3/day)	--	--	69,900	73,200
	mg/l	mg/l	mg/l	mg/l
Suspended solids	10.9	6	9.8	13
COD	--	--	11.2	7
Ammonia nitrogen-N	0.16	0.31	0.23	0.28
Chloride	61.5	56	27.7	21.
Total copper	0.00653	<0.020	--	--
Total lead	0.00672	<0.050	0.002	< 0.050

Outfall	820224 (001)		820409 (Intake)	
Sample Time & Date	9-14-82 - 0725		9-14-82 - 0850	
	Pennwalt mg/l	E.P.B. mg/l	Pennwalt mg/l	E.P.B. mg/l
Suspended solids	8.9	6	< 0.01	10
COD	6.2	6	9.7	5
BOD_5	--	--	0.4	3.1
Ammonia nitrogen-N	0.14	0.22	--	--
Chloride	15.2	9.8	21.9	16.7

1 - Flow reported corresponds to the 24-hour sampling period.

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Table 5 Comparison of the previous survey results with the results obtained in this survey.

Outfalls	821088 (006)		820223 (005)	
Survey Date From	8-17-81	9-13-82	8-17-81	9-13-82
To	8-18-81	9-14-82	8-18-81	9-14-82
Flow Rate (M^3/day)	26,600	19,100	4,900	3,060
	mg/l	mg/l	mg/l	mg/l
Suspended solids	18	5	< 4	29
Dissolved solids	160	150	16,000	29,000
COD	26	26	INT	INT
TOC	8.2	8.1	2.4	1.7
Sulfide	0.02	< 0.02	--	--
BOD_5	11.	13	--	--
Nitrite & nitrate nitrogen-N	0.49	0.20	0.40	0.29
Ammonia nitrogen-N	0.58	0.51	0.36	0.33
Kjeldahl nitrogen-N	1.5	1.8	0.70	0.64
Total phosphorus-P	0.16	0.16	0.03	0.02
Chlorides	20.	17.3	8,300	15,000
	ug/l	ug/l	ug/l	ug/l
Phenol	24	19	3	< 2
Total cadmium (Cd)	< 20	< 20	< 20	< 20
Total chromium (Cr)	< 50	< 50	< 50	< 50
Total copper (Cu)	35	< 20	85	35
Total nickel (Ni)	< 50	< 50	< 50	< 50
Total lead (Pb)	< 50	< 50	< 50	< 50
Total zinc (Zn)	< 50	< 50	< 50	< 50
Total iron (Fe)	460	280	410	300
Phenols Scan[1]				
Phenol	--	13	--	U (<10)
Others	U	U	U	U (<250)

1 - The parameters included in this scan have changed from the 1981 to 1982 surveys.

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Table 5 (continued)

Outfalls		820193 (003)		820190 (002)	
Survey Date	From	8-17-81	9-13-82	8-17-81	9-13-82
	To	8-18-81	9-14-82	8-18-81	9-14-82
Flow Rate (M^3/day)		20,800	13,800	72,900	73,200
		mg/l	mg/l	mg/l	mg/l
Suspended solids		19	14	15	8
Dissolved solids		170	770	150	170
COD		9	8	8	6
TOC		2.6	1.2	2.3	1.0
Nitrite & nitrate nitrogen-N		0.51	0.29	1.4	0.25
Ammonia nitrogen-N		0.34	0.25	0.29	0.23
Kjeldahl nitrogen-N		0.53	0.59	0.55	0.41
Total phosphorus-P		0.10	0.06	0.06	0.03
Chlorides		28.	56	22.	20
		ug/l	ug/l	ug/l	ug/l
Phenol		4	2	7	--
Total copper (Cu)		13	< 20	--	--
Total lead (Pb)		< 5	< 50	< 5	< 50

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Table 5 (continued)

Outfall		820409 (Intake)	
Survey Date	From	8-17-81	9-13-82
	To	8-18-81	9-14-82
		mg/l	mg/l
Suspended solids		11	7
Dissolved solids		130	140
COD		9	5
TOC		1.7	1.9
Sulfide		< 0.02	< 0.02
BOD_5		3.1	2.0
Nitrite & nitrate nitrogen-N		0.39	0.17
Ammonia nitrogen-N		0.33	0.26
Kjeldahl nitrogen-N		0.55	0.41
Total phosphorus-P		0.04	0.02
Chlorides		12.3	9.0
		ug/l	ug/l
Phenol		9	4
Total cadmium (Cd)		< 20	< 20
Total chromium (Cr)		< 50	< 50
Total copper (Cu)		60	< 20
Total nickel (Ni)		< 50	< 50
Total lead (Pb)		< 50	60
Total zinc (Zn)		< 50	< 50
Total iron (Fe)		380	260
Phenols Scan[1]			
Phenol		--	U (<10)
Others		U	U (<250)

1 - The parameters included in this scan have changed from the 1981 to 1982 surveys.